THE COMPOSITION OF MILK.

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Composition of Milk during 1908.—Of the 39,469 samples analysed in the laboratory of the Aylesbury Dairy Company during 1908, 34,461 were samples of milk.

The average composition of 17,433 samples received from the farms is given in the table below.

Composition of Milk during 1908.

Month.	Morning Milk.				Evening Milk.				Mean.			
	Specific Gravity.	Total Solids.	Fat.	Solids-not-Fat.	Specific Gravity.	Total Solids.	Fat.	Solids-not-Fat.	Specific Gravity.	Total Solids.	Fat.	Solids-not-Fat.
January ...	1·0323	12·61	3·66	8·95	1·0321	12·96	3·99	8·97	1·0322	12·79	3·83	8·96
February ...	1·0322	12·46	3·55	8·91	1·0320	12·79	3·87	8·92	1·0321	12·62	3·71	8·91
March ...	1·0322	12·47	3·55	8·92	1·0320	12·80	3·88	8·92	1·0321	12·64	3·72	8·92
April ...	1·0329	12·39	3·50	8·89	1·0318	12·67	3·81	8·86	1·0320	12·53	3·65	8·88
May ...	1·0323	12·30	3·41	8·89	1·0318	12·73	3·86	8·87	1·0320	12·51	3·63	8·88
June ...	1·0324	12·17	3·29	8·88	1·0317	12·57	3·76	8·81	1·0320	12·37	3·52	8·85
July ...	1·0318	12·16	3·40	8·76	1·0311	12·48	3·81	8·67	1·0314	12·32	3·60	8·72
August ...	1·0317	12·25	3·50	8·75	1·0310	12·73	4·03	8·70	1·0313	12·49	3·76	8·73
September...	1·0319	12·50	3·65	8·85	1·0314	12·97	4·14	8·83	1·0317	12·74	3·90	8·84
October ...	1·0322	12·58	3·66	8·92	1·0319	13·08	4·15	8·93	1·0321	12·88	3·90	8·93
November...	1·0325	12·69	3·70	8·99	1·0322	13·10	4·10	9·00	1·0323	12·90	3·90	9·00
December ...	1·0325	12·76	3·75	9·01	1·0322	13·04	4·05	8·99	1·0324	12·90	3·90	9·00
Average...	1·0322	12·44	3·55	8·89	1·0318	12·83	3·95	8·88	1·0330	12·63	3·75	8·88

There is the usual difference between the morning and evening milk of 0·4 per cent., and the lowest fat occurs in June and the highest in the last four months of the year. It is a little unusual that the same average percentage of fat should have occurred in four successive months, as it has been generally found that October and November are the months in which the fat is highest, while September and December are not quite so good. As an indication of the influence of the temperature of the air on the quality of milk, it may be mentioned that October and November were mild, while a cold spell occurred in December; mild weather has a tendency to occasion a flush of milk comparatively poor in fat, whilst cold weather acts in a contrary direction.

The average percentage of fat found during 1908 is the same (3·75) as that found in 1907, and agrees with the average of the past ten years.

In continuation of the tables published during the past three years, the incidence of samples containing less than 3·0 per cent. of fat on the morning milk during May and June is given.

	Percentage of Samples containing			
	2·9 to 3·0 per Cent. Fat.	2·8 to 2·9 per Cent. Fat.	2·7 to 2·8 per Cent. Fat.	Below 2·7 per Cent. Fat.
May, 1908 ...	0·6 per cent.	0·5 per cent.	0·2 per cent.	nil
June, 1908 ...	2·3 ,,	0·4 ,,	0·2 ,,	nil

The number of these samples is less than in former years.

Some Uses of the Determination of the Aldehyde Figure.—I trust that I may be permitted to again refer to the aldehyde figure, but the great use that this determination has been is my excuse.

During the past year I have had to control the preparation of a number of milk mixtures made up for infant feeding from prescriptions, and in some of these it has been necessary to estimate rapidly fat, proteins, milk-sugar, and cane-sugar. The problem was simplified by all the materials used being available for analysis, and it was found that by determining fat (by the Gerber method), specific gravity, and aldehyde figure, in the samples and in the milk from which the samples were made, the four determinations required could be obtained with sufficient accuracy for control purposes.

By estimating the ratio of solids-not-fat to aldehyde figure in the milk used, and multiplying the aldehyde figure of the mixture by this ratio, the amount of solids-not-fat derived from the milk is obtained, and the difference between the actual amount and this gives the added sugar. Test mixtures were made up containing 3·15 per cent., 2·30 per cent., and 2·23 per cent. of cane-sugar, while 2·90 per cent., 2·44 per cent., and 2·13 per cent. of cane-sugar was found in these. The method does not, of course, distinguish between added cane-sugar or added milk-sugar, but when it is known what the added substance is, an estimation of sufficient accuracy is obtained.

The aldehyde figure is also of use in the estimation of salt in milk or butter-milk. It sometimes happens that when churning both salt and water find their way into the butter-milk; when the butter-milk is to be sold, it is important to be able to rapidly estimate both the proportion of water and of salt.

It was found that chlorides could be titrated in milk with $\frac{N}{10}$ silver nitrate solution, using potassium chromate as indicator, and that 10 c.c. of milk took on an average 3·45 c.c. $\frac{N}{10}$ silver solution, with extremes of 3·35 c.c. and 3·6 c.c. in nine samples. It was further found that the number of c.c. of $\frac{N}{10}$ silver solution for 10 c.c. of milk could be deduced with considerable accuracy by multiplying the aldehyde figure (obtained with $\frac{N}{10}$ strontia) by 0·171, and subtracting this quantity from the quantity actually used; the remainder was a measure of the sodium chloride.

A series of determinations showed that 1 gram of sodium chloride added to

100 c.c. of milk raised the density by 0·00735, and by multiplying the amount of salt found by this figure the increment of density due to the addition is deduced, and subtracting this from the density found, the density of the milk is obtained. From this last figure and the fat the solids-not-fat can be calculated, and from this the amount of added water roughly deduced.

The following figures will show the accuracy of the method :

	1	2	3	4	5
Salt added ...	0·49	0·485	0·71	0·32	0·62
Salt found ...	0·47	0·490	0·71	0·31	0·62
Water added ...	10	—	10	20	35
Water found ...	10	—	9	19	34

Adulteration of Cream with Condensed Milk.—It is now a fairly common practice, especially in the North of England, to mix condensed milk with cream. A sample which came into my hands contained :

	Per Cent.
Total solids	37·89
Fat	27·42
Ash	1·23
Solids-not-fat	10·47

A genuine cream containing this percentage of fat would contain 6·5 per cent. of solids-not-fat.

Discussion.

Mr. John Golding said that, although Mr. Richmond's figures were most acceptable, and were looked for with interest by people all over the country, they did a certain amount of injustice to some farmers in the Midlands who had to milk their cows at very uneven intervals. He should like to ask if Mr. Richmond had experienced any difficulty with regard to sampling. With milk that had stood over night, even after a railway journey, he (Mr. Golding) had found it almost impossible to get the fat thoroughly distributed without using a perforated disc or pouring the milk from one churn to another. In two recent cases which he had had to investigate it was clear that the vendors had suffered injustice through uneven distribution of the cream throughout the vessel sampled.

Mr. L. Myddelton Nash said that, while according to Mr. Richmond's figures the proportion of non-fatty solids did not seem to vary appreciably from month to month, he understood that the yield of casein from separated milk varied considerably at different seasons of the year—he believed from 3 to 3·8 per cent. If that were so it would seem that the lactose and salts should vary inversely with the percentage of proteins, and he should like to hear if Mr. Richmond had any information on this point.

Mr. Moor desired to ask whether the average of 3·75 per cent. of fat had been obtained by taking the average of the whole number of samples that Mr. Richmond

dealt with, because he (Mr. Moor) had heard it stated that in making up these averages Mr. Richmond took out the figures of the milks which fell below the Government standard, or below some other standard, thereby intentionally obtaining a false set of figures.

The PRESIDENT remarked that, as he had mentioned a little time ago, some difficulty had been created in Scotland by the returning as "abnormal" of a very large proportion of milk samples in which the non-fatty solids were below 8·5 per cent., and he thought it would be interesting if Mr. Richmond would state what percentage of his samples might be classed as abnormal in this respect.

Mr. RICHMOND said that the number of samples in which the non-fatty solids fell below 8·5 per cent. was very small indeed, and only two samples (one of which was from a single cow) contained less than 8·3 per cent. Most of the cases in which there was a low percentage of non-fatty solids occurred within the months of July, August, and September. With regard to sampling, each churn was stirred with a stirrer before the sample was taken. He had not the figures for casein, but the total proteins, as shown by the aldehyde figure, varied a little according to the season of the year, being higher in the winter and lower in the spring, summer, and autumn. In reply to Mr. Moor's question, the average he had given was practically an average of the total samples. The only samples rejected were those in the case of which there was distinct evidence that the milk had been tampered with. The number rejected in the course of the past year was twenty-one, the total number being 17,000 odd. This, of course, was a very small proportion, and even if the rejected samples had contained no fat at all, it would scarcely affect the average percentage of fat in the second decimal place. For a sample to be rejected for lowness in fat he required some such evidence as the arrival of the milk in a churn of which the seal had been broken and in which the quantity of milk did not correspond with the quantity stated on the label—*i.e.*, there must be absolutely definite evidence that something had been removed from the churn. In the absence of such evidence the sample was included in the average. It was therefore absolutely untrue to say that the averages he gave were manipulated in any way so as to cause them to be higher than they actually were. He understood from Mr. Moor that the statement referred to was made in court, and he should like to warn the gentleman who made it that he laid himself open to an action at law. He (Mr. Richmond) very much resented any imputation of that kind, and he was grateful to Mr. Moor for raising the question and giving him an opportunity of denying it.